

SK95 1.4 etc.

INSTALLATION INSTRUCTIONS

We have supplied installation instructions for the INOVA memory card, written by Jim Switz and Lowell Streiker of Microtech, with technical support by M. Joel Guerra, the designer of the INOVA 500 and the INOVA 1000.

If you are installing the card, please take the static electricity warnings very seriously, as the 256K DRAM chips are very sensitive to this danger. After installation, use the RAMTEST program supplied to test the entire memory. The program runs continually, so you can stop it after a few minutes. If you get any error messages, contact your dealer.

ABOUT YOUR INOVA EXPANSION CARD...

This Executive memory card upgrade is unusual in that, when installed, it is actually additional banked memory for the Executive, instead of port-mapped or co-processor-controlled memory. Consequently, the INOVA card requires less electrical power, less software overhead for control (and even that software does not take away from your program space), and Z80 instructions can be directly executed within any bank, saving even more time and space. And it's fast, too -- the entire contents of a standard Executive floppy diskette can be read into the INOVA 500 or 1000 in less than 20 seconds with our software, and MBASIC can be loaded in 1/2 second from the RAMdisk (compare that with 4-5 seconds from floppy!) Also, pressing the RESET button does not erase the contents of the RAMdisk.

Your original Executive memory card, 128K of RAM, is divided into two banks, Bank 0, with 64K of memory, and Bank 1, with 60K of memory. (4K of memory is not available in the Executive's banked memory scheme. The top 4K of Bank 0 appears in all other banks as well.) The INOVA 500 is divided into 8 banks, 0 through 7, while the INOVA 1000 also has banks 8 to 15. The first two banks, Bank 0 and Bank 1, are exactly like the Executive's original memory, making the memory card totally compatible with existing software. The remaining memory can be used as the owner sees fit, as RAMdisk, print buffer or spooler, and/or extra memory for other background tasks. The RAMTEST program displays a memory map of the memory card when you run the program. (NOTE: only 8 banks are displayed. If you own the INOVA 1000, don't let this fool you!)

For those of you new to the RAMdisk concept, a RAMdisk is simply a portion of the computer's electronic memory that emulates a small hard disk drive or a non-removable floppy disk drive. That is, to the operating system of your computer, a RAMdisk acts just like a floppy disk drive -- except that a RAMdisk can be up to 20 times faster than a floppy disk drive. A floppy drive requires time to turn on, to move the read/write head to the desired track on the diskette, to rotate the diskette so that the actual data desired can be read, to feed the data, one bit at a time, to the computer to be stored in its memory. To the computer, access to

ANY portion of the RAMdisk memory is comparatively instantaneous. This is what makes RAMdisks so popular with computer users.

One advantage that the INOVA memory card has over its competition is the ability to skip a step in loading data into the portion of memory set aside as RAMdisk. In other RAMdisk schemes, a file-copy program like PIP or NewSWEEP must be used to copy files from floppy to RAMdisk. This requires that the file be read into the computer's memory first, then written from the computer's memory through a "port" to the extra memory installed as a RAMdisk. Since the INOVA card IS the computer's memory, the second step can be skipped with appropriate software. The software we supply with the INOVA 500 and 1000 can "mass read" or "mass write" a standard Executive floppy diskette (183K of data plus 2K of directory) in about 17 seconds! Larger capacity floppies can also be read with comparable speed.

INOVA 500 AND 1000 SOFTWARE

The following programs should be on the diskette included with your INOVA 500 or 1000 package:

RD.COM	SKEYS.COM
SPOOL.COM	SKUTIL.COM
SPRINT.COM	COPYSKEY.COM
FOTO.COM	FKEY.COM
SWAP.COM	SKEY.COM
SDS.COM	SYSKEY.COM
360.COM	WSPATCH.COM
390.COM	DVORAK1.COM
360SKEYS.COM	DVORAK2.COM
PATCH360.COM	QWERTY.COM
PATCH390.COM	INOVA.CHR
ROM12.COM	MKR.COM
WSV.COM	
WSV.DOC	
MAKEST20.COM	
MAKEST20.DOC	

The second column's programs are documented in the SKEYS manual. MAKEST20 and WSV have their own documentation. We're concerned here with the first five programs.

[For those of you to whom this is an upgrade, SKEYS is now REQUIRED for the running of the RAMdisk/print buffer/spooler software. This is because SKEYS loads in a memory manager to prevent collisions between different programs. (Complete documentation of the memory manager and taskmaster interface standards and usage is forthcoming.) REPLACE YOUR OLD skeys.com, skeys.ovl, skutil.com, syskey.com, rd.com, AND foto.com WITH THE NEW SKEYS and support programs; they have been updated and any mix of old software and new will cause your system to "crash". Note that there is no longer a SKEYS.OVL file needed; it has been integrated into the SKEYS.COM file. Also note that the print

buffer software has been made a separate program. G2 owners: Replace all your INOVA-supplied G2xxxxxx.COM files with this new software. It now works on standard, Future Systems and G2 systems. Note than the exceptions to the above facts are the 360.com and 390.com programs. See their descriptions later in this manual.]

SKEYS must be run before RD, SPRINT, or SPOOL can be run. Attempting to run any of these programs without SKEYS will result in an error message telling you about the requirement.

USING THE RAMDISK SOFTWARE

To read a floppy directly into the RAMdisk, try "RD Rx" where "x" is the name of a valid floppy drive. When you do this, RD will attempt to mimic your disk in format and size and will then read all data from the disk into memory (we call this a "mass read"). It then installs itself as the next available drive name. For example, if you have two floppy drives, A and B,

RD RA<cr>

would read the floppy disk in drive A into the RAMdisk and assign it to be drive C. If you already had a drive C that was not an INOVA RAMdisk, the new RAMdisk would become drive D, and so on.

The following scenario might be typical of your use of the RAMdisk. You start by booting your computer with a disk that contains SKEYS and RD. You run SKEYS and then type "RD RB". This reads your drive B floppy into the RAMdisk. Then, as you use your various programs, like Wordstar and SuperCalc, you use the RAMdisk as your data or work disk. When you are ready to save that data, you replace into the B drive the disk you read from originally and into the A drive your booting diskette with RD on it, if you have removed that diskette. Then type "RD WB". This will write the RAMdisk contents to your B disk.

You can read any disk format that has a 1K physical block size, like Osborne double density, or G2 Systems double sided or quad systems, or Future Systems double sided format. However, only the standard Executive BIOS, Future Systems, and G2 BIOS are currently supported.

But you don't have to read a floppy into memory at all. You could run RD to produce a RAMdisk to your precise specifications, as in,

RD 310/256

which would create a RAMdisk with a 310K total space and a directory large enough to hold 256 entries (the normal number is 64 for a disk that size.) Since the directory would take 8K of space, your free space on the new RAMdisk would be 302K. You could then copy 302 kilobytes in utilities or data to the RAMdisk

with a file transfer program like PIP or NSWEEP.

You could even perform a combination of the two commands. The line, "RD 255 RB" would read the floppy disk in drive B and create a RAMdisk that is 255K in total size!

Note that certain combinations of drive size and actual floppy disk size are incompatible with CP/M standards and will generate an error message from RD if attempted. For example, "RD RA 256" cannot be used with a standard double-density floppy because any disk with more than 255K of total storage MUST use at least a 2K block size, while the standard format uses a 1K block size.

RD also lets you write the contents of the RAMdisk back to a floppy drive of the same format with the command "RD Wx" where "x" is the name of a valid drive. You will be asked if you really want to do this.

Be aware that if you perform a command like "RD RB 255", (the order of commands is unimportant) then you will not be able to write the RAMdisk back to the floppy because the two "disks" are of different "formats". That is, the RAMdisk is a 255K "floppy" while the real disk is only 185K.

The full RD syntax specification is:

```
RD [size.in.K][/#.of.directory.entries] [rx|rxY|wx|wxY] ! [REMOVE] ! [RECOVER]<cr>
```

to make more use of its special features. (The brackets '[' indicate optional parameters while the vertical bars '|' denote mutually exclusive ones.) Size.in.K can range from 3 to 800 (if you have an INOVA 1000 memory card, and even larger sizes are supported, up to 2 megabytes). #.of.directory.entries is optional, and ranges from 64 to 512. Other values entered are adjusted to CP/M specifications.

Examples:

1) RD 3 -- This would create a 3K RAMdisk with a 2K directory for 64 directory entries and 1K of free disk space.

2) RD 300/512 -- A 300K RAMdisk would be made with room for 512 directory entries, using 16K of space, leaving 284K of space for data.

3) RD RA RB -- An error will be generated because the command calls for two disks to be read and RD only knows how to read one. See 360.com and 390.com descriptions for more information on reading two disks.

4) RD RA WB -- This will also create an error because RD cannot read and write in the same run of the program. Instead, use "RD RA!RD WB" which will run RD twice.

This program will work AS IS on standard, Future Systems and G2 Systems Design drives. Note however that you can't do a mass read from a floppy diskette to a RAMdisk that is smaller than the floppy. The maximum size of RAMdisk on the INOVA 500 card with

this version of RD is 320K. A program, SDS, has been provided to create special size diskettes that have the same floppy format, but contain less blocks of data. Syntax:

SDS x size<cr>

where x is floppy drive A or B
and size is the maximum new size
of diskettes in the selected
drive.

If you run this program, you must run it before RD, and then after RD to reset the drive back to its original size. This goes whether you are doing a mass read or a mass write with RD. Also, please see the descriptions of 360.com and 390.com for more details concerning full utilization of the INOVA 500 memory.

To remove the RAMdisk from memory and therefore release the banks that were being used by it, say for SPOOL, use "RD REMOVE".

To do only a recovery of a RAMdisk after a computer reset try, "RD RECOVER". At any time, however, if RD recognizes that a RAMdisk did exist, and you attempt to change it, as in the case of an overwrite, you will be asked if you really want to do this.

If you do not wish to be asked whether or not to overwrite the destination diskette or RAMdisk contents, you can append a "Y" to the "Rx" or "Wx" options, as shown in the syntax definition above. This option is provided for those diehards who want to do just that.

"RD<cr>" will generate a menu walk-through which prompts the user through a RAMdisk installation or recovery. Try it; you'll like it, possibly even the snide remarks it makes from time to time.

PRINT BUFFERING/SPOOLING with SPOOL.COM AND SPRINT.COM

There are two programs which will set aside a portion of your INOVA 500 or 1000 as a print buffer available for your use, SPOOL and SPRINT. A print buffer is useful because it can receive the characters your application sends to the "printer" much faster than almost any printer can print. It is possible to send characters to our print buffers at a rate of almost 3000 characters a second -- that is, if your program could send them that fast, the buffer could receive them that fast. (WordStar is notoriously slow to send characters due to the extra processing it does when it prints.) Most personal computer printers, meanwhile, can only print between 40 and 200 characters a second. This means that the buffer can typically receive characters 25 times faster than the typical printer can print. For print tasks less than 59,000 characters, you can possibly be done printing to the buffer in 1/25th the time it would take to print to your printer, and can then use your computer for other tasks, while your buffer sends characters out to your printer at its own rate.

If you do not have a parallel printer, you must use the SPOOL program.

If you have a Trantor/WestWind hard disk with its own parallel port to which you have a parallel printer attached, you must use the SPOOL program.

If you have a parallel printer like the Gemini 10X or other printer that can't print while it is receiving characters, we recommend that you use the SPOOL program. You can use the SPRINT program, but it will appear to be slow.

If you generally use an application that does not ask for a character until one is ready, that is, it checks "character status" continually instead of just asking for a character (like SuperCalc [tm Sorcim] or the public domain VDO editor), we suggest that you use the S option on SPOOL or use SPRINT, if you can. If you do not, the buffer will only print one character for each one you type at the keyboard. The S option commands SPOOL to print when an application check the status of the keyboard, as well as when the program requests a character. To do this type "SPOOL S" when the program is run for the first time, i.e., in your boot chain.

If you have a parallel printer, you can use the SPRINT program to install a true BACKGROUND print buffer, which will print to your printer even while you are doing other tasks, like editing or compiling programs. A print buffer will print even when the computer is not looking for a key from the keyboard (unlike spoolers, which can't print otherwise). Printing will only pause when the computer's interrupts are disabled -- usually only during floppy disk accesses.

The differences between SPRINT and SPOOL are minor enough that the instructions for use for both programs have been combined.

The major differences are 1) SPRINT prints in BACKGROUND, at the interrupt level of the Executive, while SPOOL prints only when the current application is waiting for you to type a character on the keyboard; 2) SPRINT will only work with a parallel printer, while SPOOL allows you to change printers.

After SKEYS is loaded, just type:

SPRINT<cr> or SPOOL<cr>

to install the print buffer as a background task. If either SPRINT or SPOOL has already been run, you will be told that something is already loaded. If not enough memory is available for the task (which is likely if you ran RD and told it to use all available memory), you will be notified also.

```
*****
*
*   NOTE: Under normal circumstances, SPRINT and SPOOL,
*   like SKEYS, will survive a RESET and re-boot. Like
*   SKEYS, however, SPRINT or SPOOL must be re-run to re-
*   install the "hooks" in the newly-reloaded operating
*   system. Otherwise, you will have access to the print
*   buffer through the control-shift-Q menu, but anything
*   you print will not take advantage of the buffer. If
*   you have run one type of buffer and wish to run the
*   other type, you must TURN OFF the Executive, wait a few
*   moments, turn the Executive back on, and re-run SKEYS.
*   Versions of the buffer software are planned which will
*   allow removal of an existing print buffer.
*
*****
```

You can control your print buffer by pressing control-shift-Q to access the print buffer menu. (If you have other background tasks loaded, you may have to press control-shift-Q more than once, until the word SPRINT or SPOOL is highlighted on the task menu.) You will see one of the following menus:

SPRINT

Parallel Printer Buffer Status: Not Paused - 00K to print

Select one of the following (or ESC to exit):

- 1) Stop printing
- 4) Pause printer after formfeeds - OFF
- 5) Repeat from start (00K reprintable)
- 6) Bypass buffer - OFF
- 9) Clear buffer

SPOOL

Print SPOOLing Status: Not Paused - OK to print

Select one of the following (or ESC to exit):

- 1) Stop printing
- 3) Change printer -- currently PARALLEL
- 4) Pause printer after formfeeds - OFF
- 5) Repeat from start (OK reprintable)
- 6) Bypass SPOOLer - OFF
- 9) Clear buffer

As you can see, you can stop printing by pressing 1. When you do, the 1) menu item is replaced by

- 2) Resume printing

and the status line will say "Paused".

You can resume a paused print without entering this menu, by pressing control-shift-Y.

You can pause your printer after formfeeds automatically for cut-sheet feeding. Just select item 4 from the menu, and the "OFF" will change to a highlighted "ON". Now, as you print, when a formfeed is encountered, it is sent and the printing is automatically paused. To continue printing, you could press control-shift-Q, 2, <ESC> -- or just simply control-shift-Y, after you insert a new sheet of paper in your printer. If you are used to telling WordStar to pause between pages, you need to start telling it otherwise, since having WordStar do it defeats the purpose of the print buffer.

Note: If WordStar is still printing when you press control-shift-Q to look at the menu or control-shift-Y to resume printing, YOU NEED TO PRESS another key, like <ESC>, to satisfy WordStar. WordStar detected that you had pressed a key, and asked the operating system for it (to check if it was a P for pause print), but SKEYS trapped the key, processed it, and is now waiting for another. This will "hang" WordStar until you press another key, one that will satisfy WordStar. See the SKEYS manual, Appendix A: "Restarting", for more information on the subject.

Your print buffer is a 59-Kbyte CIRCULAR print buffer, circular in that printing to the buffer will "wrap around" to the beginning if you are printing more than 59,000 characters. In this way, you are not limited to printing 59K or less at a time. (If you fill the buffer, you will not be able to use your computer until enough characters are printed so that the buffer is no longer full -- but then, you generally couldn't use your

computer at all while printing before.)

If you do not fill the buffer completely, option 5 will remain open to you. This option allows you to restart the print task from the beginning. This can prove useful not merely for making multiple copies of what you print, but for those times when you started printing and discovered that something was wrong: no paper in the printer; wrong initial font, lines/inch, form size, etc. To correct this situation, press control-shift-Q to get to the menu, then press 1 to pause print. Fix your problem -- if it is the wrong font and you can send a function key out to your printer to fix it, use option 6: Bypass buffer. (Using this option will automatically pause print.) After the problem is fixed, select option 5 to reset the print task back to the beginning, then option 2 to resume printing.

Please note that option 5, repeat from start, will not be available for print tasks longer than 59K. (Obviously -- the beginning of your print task was "walked on" by the end of the task.) Also, the buffer is cumulative -- unless you specifically clear the buffer prior to printing a new task, any old tasks will also be reprinted in sequence.

This brings us to option 9: Clear buffer. This resets the buffer for new print tasks, and for the FOTO program, which allows you to write a screen-print to a disk file. If you select option 9, you will be asked if you are sure. You must press a "Y" or an "N" to get past the question.

SPOOL allows you one more option: That of changing your printer. If you have two printers, one hooked to the serial port and one to the parallel, SPOOL may be of great value to you. To change printers, select option 3. You will be asked to press a letter corresponding to a printer type. The type you select will then be displayed on the main SPOOL menu.

(Note: IEEE printers are not supported because the BIOS drivers do not contain any printer status routines -- they always return saying they are ready to print, whether they are or not. This may hang up the computer, leaving you with the same effect as if you did not have SPOOL installed.)

You may have noted that one of the options allows you to send output to your CRT screen. You could print a small task to your screen to see how it would look, then select the actual printer and repeat the print task.

360.COM allows you to create a 360K RAMdisk (358K of file space and 2K of directory space, for up to 64 files) when used with the INOVA 500 memory card. It cannot be used with the standard bank-2 SKEYS nor with RD; however, if the use of SKEYS is still desired, a special bank-zero version has been provided. This version, 360SKEYS.COM, will work only on the INOVA 500 memory card, and only when the Osborne Executive standard operating system has been patched with PATCH360.COM.

360.COM also provides you with the ability to mass-read and mass-write the contents of the 360K RAMdisk from or to two floppy diskettes. With this program, you can create a file on RAMdisk larger than the standard Executive floppy diskette and automatically split it and save it on two diskettes.

At any time, to create a 360K RAMdisk, merely type 360<cr>. If a bank-2 SKEYS is running, you will be told, since you cannot have a 360K RAMdisk and bank-2 SKEYS at the same time. To copy files to and from the RAMdisk, use PIP or NSWEEP or the file-copy option of WordStar(tm - MicrPro). If you wish to create a set of special floppies for mass-reading and -writing, you must first create a RAMdisk in this way, copying the files to it that you desire to have on your special diskettes.

Then, to "back up" the RAMdisk onto floppies, you must first put two non-write-protected, formatted diskettes in the floppy disk drives. Then run the 360.COM program with the W option:

360 W<cr>

The 360.COM program will prompt you for confirmation, then, if you approve, it will write the contents of the 360K RAMdisk to logical floppy B first, then to logical floppy A. Please note that the logical floppy drives should correspond to the physical floppy drives; if you have used SWAP.COM to switch the drives, you should use it again to switch them back. Also note that if the 360.COM program is not on the RAMdisk, you must load it from the logical A drive to allow you time to replace the diskette with the second diskette for the 360K mass write, while the first diskette is being written to. (Otherwise, the 360.COM program -- and everything else on that diskette -- will be overwritten by the second half of the RAMdisk image.)

The two diskettes created with the 360.COM program in this manner will each display a single filename, either 360KDISK 1 or 360KDISK 2, when you try to get a directory of one of these diskettes. Also, any attempt to write to either of these diskettes will result in a CPM error telling you that the directory of the destination drive is full, to protect the contents of these diskettes. If you wish to re-use these diskettes as standard Exec floppies, just reformat them or overwrite them with the COPY program.

These filenames are also used by the 360.COM program to determine whether the diskettes are read in the correct sequence. You will be told if you attempt to read a wrong-format diskette, or 360KDISK 2 first instead of 360KDISK 1.

To mass-read these two special diskettes into a 360K RAMdisk, merely type 360_R<cr>. You can do this from a standard diskette containing the 360.COM program in the A drive; and while the contents of 360KDISK 1 are being read into the RAMdisk, you can replace your boot diskette (with the 360.COM program on it) with the 360KDISK 2 diskette, to be read by the executing program when it finishes with 360KDISK 1. It takes about 17 seconds to read each diskette.

It is strongly recommended that you make duplicate copies of the data you value. Also, use high-quality diskettes whose hub-rings are properly centered: if the hub-ring is not centered, you will have problems reading a diskette (try popping the drive latch and re-inserting the diskette).

The 360K RAMdisk will, under normal conditions (no power failure, no experimental program gone hog-wild, hanging the machine), survive a press of the RESET button, even if the computer says "Performing SELF-TEST" as it may do often on some machines. If you attempt to run the 360.COM program again after a "normal" RESET, you will be asked if you want to overwrite the existing RAMdisk. If you do not, simply answer "N" to the question, and the RAMdisk will be recovered.

Note: Unlike the SKEYS and RD programs, the 360.COM program is not compatible with either Future Systems or G2 drive upgrades. It is, however, somewhat compatible with the Trantor/Exec-T/WestWind products (you cannot patch your operating system for 360SKEYS, however).

390

The use of the 390.COM program is virtually the same as the use of the 360.COM program, with several considerable exceptions. The 390K RAMdisk created with this program will NOT survive any RESET, as a portion of its directory is overwritten upon re-boot. The 390.COM program will not run UNLESS the operating system on your boot diskette has been patched with PATCH390.COM. There is NO version of SKEYS, bank zero or otherwise, that will run concurrently with 390.COM. This program is not compatible even with the Trantor/Exec-T/WestWind product line.

It does, however, provide you with almost 400K of RAMdisk (388K of file space, 2K of directory space for up to 64 files), if you need the space more than SKEYS. The syntax and capabilities of 390.COM are otherwise the same as those for 360.COM; see the 360.COM program instructions for the use of 390.COM, after using PATCH390.COM to patch your operating system.

FOTO

Screen prints through SKEYS are accomplished with control-shift-P. If SPRINT or SPOOL has been loaded, AND you have cleared the buffer before making your screen-print, you can copy the screen-print to a disk file. Just exit your application and get to the CP/M prompt. Then run the FOTO program:

```
FOTO filename<cr>
```

where "filename" is the name of the disk file to contain your screen print. Any file by the same name on the diskette will be replaced by the new file, unless the old file is read-only, in which case you will be faced with yet another difficult decision: you will be asked if you want FOTO to delete the old file.

Please note: FOTO expects the screen-print to be the first 2K in your print buffer. If you did not clear the buffer prior to the screen-print, and you had previously printed something through the buffer, your file would contain... well, not what you wanted.

SWAP

SWAP is a program that allows you to reassign your logical drives. Any logical drive can be "swapped" with any other. The syntax is:

```
SWAP xy<cr>    where x and y are any two valid drives.
```

RD will read or write to any valid logical drive, as long as it is a floppy. If it is not a floppy drive (as in the case of a hard disk logical drive), an error message will be generated and no read or write will take place. You can use SWAP with impunity.

SWAP is very useful when WordStar has been loaded into the RAMdisk and you have logged a floppy drive for your data files. For example, if you had logged floppy drive B from RAMdisk C, WordStar would then look for its overlays on floppy drive A. But the command:

```
SWAP AC<cr>
```

makes the top floppy drive C and the RAMdisk drive A the first time you run it, and WordStar will remain lightning fast in execution from the RAMdisk. Re-running the command will restore the top floppy to drive A and the RAMdisk to C.

Technical Notes on the INOVA 500 and INOVA 1000

Using the Extra Memory in Programming

For those who wish to access the extra banks of memory through assembly-language programming, the following should prove helpful:

In the Osborne Technical Manual, bank zero is always selected, while bank one is selected by setting bit 0 (the rightmost bit) of the bank selection byte. The video bank is enabled by setting bit 6 (they call it bank 7), and the ROM/font RAM/ROM's RAM bank is switched in by setting bit 7 (bank 8).

This still applies in the INOVA 500 and INOVA 1000. HOWEVER, do not otherwise use the bank scheme as indicated in the Osborne Technical Manual, where one bit represents one bank. Use a binary counting scheme to select the normal RAM banks provided by the INOVA memory cards. In this scheme, bank 7 of RAM (not video) would be represented by the low-order three bits set. OR in (or AND out) the ROM and VIDEO banks as before. The bit patterns for the particular banks are:

INOVA 500/1000									INOVA 1000 only								
Bit	R V								Bit	R V							
	7	6	5	4	3	2	1	0		7	6	5	4	3	2	1	0
Bank 0	0	0	0	0	0	0	0	0	Bank 8	0	0	0	0	1	0	0	0
Bank 1	0	0	0	0	0	0	0	1									
Bank 2	0	0	0	0	0	0	0	1									
Bank 3	0	0	0	0	0	0	0	1									
Bank 4	0	0	0	0	0	0	1	0									
Bank 5	0	0	0	0	0	0	1	0									
Bank 6	0	0	0	0	0	0	1	1									
Bank 7	0	0	0	0	0	0	1	1	Bank 15	0	0	0	0	1	1	1	1

You can directly examine this memory with the control-shift-M memory editor function of SKEYS. It's possible to create a RAMdisk with RD, then examine files (and even change them and write them back to memory) through the memory editor. Keep in mind that the bank number is entered in decimal, and that if you want to toggle the ROM and VIDEO banks in and/or out, use the R and V keys. Read the SKEYS manual to find out more.

In general, all RD-created RAMdisks have their directory in Bank 2, starting at location 0000h. There are up to 20K total in Bank 2, including both directory and file space, and there are up to 60K of file space in each subsequent ALLOCATED bank of memory. The allocation is done by the memory manager installed by SKEYS. If you have loaded the RAMdisk with RD as the first thing involving the extra memory, then these allocated banks of memory will be contiguous, starting with Bank 3. However, bank 3 might conceivably be used by SPRINT or SPOOL, which means that the

RAMdisk probably continues in bank 4. Or, in another possible (though unlikely -- typical example!) scenario, you first create a 185K RAMdisk (183K file space + 2K directory space), then you run the SPOOL program, and then you create a 255K RAMdisk. This results in 20K of bank 2, 60K of bank 3, 60K of bank 4, and 45K of bank 5 first reserved for the 185K RAMdisk, then bank 6 is reserved for the SPOOL program buffer, and finally bank 7 is allocated to the 255K RAMdisk (and the remaining 15K of bank 5) to give you a non-contiguous RAMdisk. Fortunately, the software does it all with mirrors -- you don't have to worry about a thing.

However, you can find out for sure by looking at address 0C004h in bank 2 (VIDEO switched out). There are 64 bytes, starting at this location, which represent the 64 possible banks that the memory manager can control. A 0FDh in any of these bytes indicates that the corresponding bank is allocated to RAMdisk. Please note that the first byte at 0C004h represents bank 0, and the 64th byte is for bank 63.

The INOVA 500/1000 RAM Chips

The type of RAM chip used in the INOVA 500 and 1000 memory cards are very reliable once installed inside your computer. If for any reason a memory chip should fail outside the one-year warranty and you wish to repair it yourself, just about any 256Kx1 dynamic random-access memory chip should work: we've used the Hitachi HM50256, the NEC D41256, the Toshiba TMM41256, and others by manufacturers like Fujitsu. DO NOT attempt to use the 256K chip that is organized 64Kx4; it definitely won't work (18 pins won't fit easily in 16-pin hole outlines).

You can mix manufacturers without worry. Just make sure that the replacement chip has an access time of 150 nanoseconds or faster (generally shown as a -15 appended to the part number). Faster in this instance means fewer nanoseconds; 120 ns (short for nanoseconds, natch) will work just fine.